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## The Central Action of Procaine

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# THE CENTRAL ACTION OF PROCAINE\*

CLARENCE W. OLSEN, M.D.

Lewy, who recommended intravenous procaine as a treatment for tinnitus aurium in 1936 (following a report by R. Barany), stated: "Since there are so many etiologic factors in the production of tinnitus and despite this procaine hydrochloride had some effect in varying its intensity, it is assumed that the action is central."

Procaine was introduced as a local anesthetic with advantages over cocaine, especially as regards relative freedom from dangerous central effects. It was very soon found advantageous to combine the procaine with some hemostatic agent, commonly epinephrine. This greatly improved the local anesthetic effect of the drug as well as prolonging its local action. It has taken a long time for the profession to realize that under conditions of fatigue, apprehension, and shock (conditions which frequently exist when an anesthetic is to be given), epinephrine itself can become a very deadly poison. Because of the almost uniform custom of using procaine in combination with epinephrine or some closely related hemostatic agent, it is impossible to collect many cases of fatality from local anesthesia with procaine alone, and there is actually question in the minds of some authorities whether procaine injected locally has ever been solely responsible for fatality. There is, however, evidence that it can be so (Martin, 1928). It is also likely that extensive use of procaine intravenously has been long delayed because of the toxic effects observed when it was given in conjunction with epinephrine as a local anesthetic agent.

In theoretical discussions of the action of

procaine administered intravenously, considerable emphasis has been laid upon the local effects. It has been explained that because of a tendency for the drug to reach an equilibrium in the blood and in the tissue fluids, the concentration of the drug is naturally greater (seven to eight times) where blood vessels are altered by injury or inflammation.

It appears that when procaine hydrochloride is injected intravenously, the indications of a central effect are more emphatic when the solution is given rather rapidly. The objective symptoms that I have observed are lacrimation, dryness of mouth, slight flushing of the face, pounding of the heart, with overdistention of the lungs and labored respiration, tremor, and perspiration of the hands, with clamminess. The patient complains of trembling inside, a funny feeling, nervousness, dryness of the mouth, and palpitation. He may talk in a rather anxious manner and may be restless enough to want to sit up or walk about rather than lie down. The widespread objective and subjective evidences of autonomic stimulation coupled with the subjective experience of apprehension and even agitation strongly suggest that there is a central mechanism at work, probably a thalamic activation. The symptoms are similar to the syndrome described by Penfield under the term "diencephalic autonomic" epilepsy. The main differences are excessive salivation and warmth of the skin in the latter condition. However, that may be a question of the degree to which the diencephalic effect develops, and it is reported that with the procaine injections coma may ensue, as in the diencephalic epilepsy.

Recently the author and his associates have

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been engaged in studies which at first sight seem to strengthen the impression that the central action of procaine may account for some of its dramatic therapeutic effects. With the simple empirical idea that a drug known to be potent in relief of ventricular fibrillation might have some ameliorating effect in cases of cerebral dysrhythmia, the authors administered intravenous procaine to a series of patients known to have more or less severe cerebral dysrhythmia. These patients suffered from a rather wide variety of acute and chronic nervous diseases, and the only common denominator was cerebral dysrhythmia. Not only did the dysrhythmia show dramatic improvement coincident with the administration of procaine hydrochloride, but simultaneously the subjective and objective symptoms, both neurologic and psychologic, likewise responded in a very encouraging way.

Neither vasodilatation of the cerebral vessels nor general stimulation of sympathetic nerve endings has so far been demonstrated to exert such effects on the function of the central nervous system as we have observed with procaine.

Probably some of the central effects of procaine can be obtained with local infiltration. This is, of course, generally admitted when untoward results occur, but it should also be considered in connection with the favorable

effects. Macpherson recently expressed the idea that in some cases we are getting the beneficial effects of procaine injection through central action even though the injection is purposely given at or near the site of the pain.

It is interesting to recall that when morphine was introduced into medical practice it was considered advisable to inject it into the site of the pain which required treatment. The *Encyclopaedia Britannica*, in its eleventh edition (1911), represents this concept pretty well when it states that ordinary hypodermic injection of morphine is indicated for internal or otherwise inaccessible pains, but for sciatica, injection into the affected muscle is recommended.

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(For additional information and references, see articles by Leffingwell, F., and Moor, F. B., in this issue of MEDICAL ARTS AND SCIENCES.)

#### INDEX

1947

Abbey, J. D.: Irradiation of the nasopharynx (with Futch, C. E.), 58

Allergy: nutrition and otolaryngological problems, 56

Anatomy: left subdiaphragmatic, extra peritoneal space, 11

Anesthesia, asphyxia in, 72, 76

Anoxemia, anesthesia of, historical, 25

Anoxia: cerebral and its residuals, historical, 16, 35

cerebral, structural changes in, 68

types and causes of, 41

ultimate residuals in, 76

Apnea, types of, 49

Asphyxia: acute effects of, 70

cerebral changes in experimental animals, 68

due to anesthesia, 72

due to neo natorum, 72, 76

due to physical residuals, 76

historical, 21, 35

neonatal, historical, 23

subacute effects of, 72

Asthma, treatment of, by irradiation of nasopharynx, 59

Baumgartner, C. J.: Intestinal obstruction, 45

Bietz, A. L.: Religion and health, 7

Birth injuries, relation of cerebral anoxia to, 76